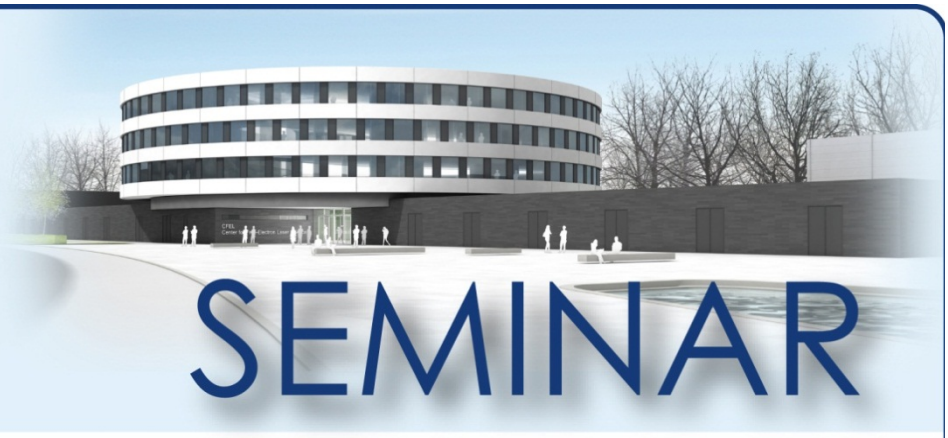
CFEL SCIENCE



SEMINAR

21st November 2013 – 13:00-17:00
CFEL-bldg. 99, seminar room V

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The Measurement of Ultrashort Laser Pulses — A Short Course

To measure an event in time requires a shorter one. As a result, the development of techniques for measuring ultrashort laser pulses—the shortest events ever created—has proved quite challenging. Indeed, this fundamental difficulty, coupled with the ephemeral nature of such incredibly short events, has resulted in a rather checkered history of this field, confounded by long periods of misinterpretations and the systemic use of problematic methods, fueled by wishful thinking and wide-spread self-deception. This course will discuss the first method, autocorrelation, and why it yields only a rough and ambiguous estimate of the pulse length, but which was nevertheless very helpful over several decades. It will then describe newer methods that reliably yield the complete pulse intensity and phase. In addition, it will show how to measure laser pulses with as little as zeptojoules of energy (less than one photon!), as well as complex pulses with time-bandwidth products of >1000. It will then describe recent methods for measuring the complete spatio-temporal intensity and phase of an arbitrary pulse—even on a single shot. Finally, it will describe very recent, successful efforts to measure the most complex pulses ever generated—also on a single shot!

This course should enable you to:

- Measure the intensity and phase of an ultrashort laser pulse;
- Verify that such a measurement is correct;
- Measure few-femtosecond or extremely complex pulses;
- Measure extremely weak pulses;
- Measure ultrafast polarization variation;
- Determine which technique is right for your application;
- Measure spatio-temporal distortions in pulses; and
- Explain the fundamental mathematics and physics behind these methods.

This course is intended for anyone with an ultrashort laser pulse who would like to measure it. Anyone wishing to perform measurements of solids, liquids, gases, or plasmas would also find these techniques useful. It's also designed for anyone who would just like to see how we can measure the shortest events ever created and, at the same time, learn about some interesting recent research.

Host: Anne-Laure Calendron & Yi-Jen Chen, IMPRS